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Research Article

Length - Weight Relationship and Condition Factor in Cichlid Fishes of Two Aquatic Environments in Imo State, Nigeria

Ezeafulukwe CF[1], Njoku DC[1], Opara AC[1], Amadi-Eke AS[1], Nwaka DE[1], Ekeledo CB[2], Adaka GS[1] and Agorua UN[3]

[1]Department of Fisheries and Aquaculture Technology, Federal University of Technology Owerri, Imo State, Nigeria; [2]Department of Fisheries Technology, Federal Polytechnic Nekede, Owerri, Nigeria; [3]Department of Fisheries and Marine Technology, Imo State Polytechnic Umuagwo, Nigeria
***Corresponding author:** emmaocy@yahoo.com

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ABSTRACT

The length weight relationship and condition factors in three cichlid fishes from two aquatic eco-ecosystems (pond and river) in Imo state were studied between May and July 2013. The species studied include *Tilapia Zilli*, *Hemichromis fasciatus* and *Oreochromis niloticus*. The length weight relationship of the three Cichlid fishes from two different aquatic environments in Imo state was: from pond, *Tilapia Zilli*, W= 0.030L $^{2.75}$, b=2.750, a =0.030, r = 0.100. *Hemichromis fasciatus*, W = 0.050L $^{2.45}$ b = 2.45, a = 0 .050, r = 0.78. *Oreochromis niloticus*, W = 0.075L $^{3.020}$,b = 3.020, a = 0.075, r = 0.82. From River, *Tilapia Zilli*, W = 0.015L $^{2.250}$, b = 2.350, a =0.015, r = 0.50. *Hemichromis fasciatus*, W= 0.045L $^{2.85}$, b = 2.350, A = 0.045, R = 0.64. *Oreochromis niloticus*, W= 0.045L 3.00, b = 3.00, a = 0.045, r = 1.00. Their pattern of growth for fishes from the pond, b for Tilapia Zilli was 2.750, *Hemichromis fasciatus* (2.450), and *Oreochromisniloticus* (3.020), whereas *Oreochromis niloticus* exhibited isometric growth rate (3.020), Tilapia Zilli and *Hemichromis fasciatus* exhibited allometric growth pattern. The growth pattern was also true for species caught from the river with 'b' as follows:*Tilapia Zilli* (2.350), *Hemichromis fasciatus* (2.850) and *Oreochromis niloticus* (3.00). The results of the correlation coefficient (r) showed that in all the pond fish, lengths were positively but insignificantly correlated with weight (*Tilapia Zilli* r = 0.20. *Hemichromis fasciatus*, r = 28) except *Oreochromis niloticus* in which length and weight were positively and significantly correlated (r = 1.00). For fishes from the river, the growth followed the same pattern as in those from the pond. For *Tilapia Zilli*, b = 2.350, *Hemichromis fasciatus* (b = 2.850) and *Oreochromis niloticus*, (b =3.00). Whereas *Tilapia Zilli* and *Hemichromis fasciatus* exhibited allometric growth rate, from the pond, condition *Oreochromis niloticus* exhibited isometric growth pattern (b = 3.00). However, the lengths of fishes from the river were positively and significantly correlated. For *Tilapia Zilli* (r = 0.40) were however, positively, but insignificantly correlated. For fishes sampled from the pond, condition factor K for*Tilapia Zilli* was 1.150. *Hemichromis fasciatus*(1.06) *Oreochromis niloticus*(1.50) For fishes from the river, condition factor K for *Tilapia Zilli* was (1.20), *Hemichromis fasciatus*(1.40) and *Oreochromis niloticus* (1.48).

Key words: *Hemichromis fasciatus*, *Oreochromis niloticus*, *Tilapia Zilli*, Cichlid Fishes, Aquatic environments

INTRODUCTION

Length-weight relationship (LWR) of fish is important in fishery biology because it allows the estimation of average weight of fish of a given length group, the conversion of length-growth equations to weight-growth equivalents (such as length-at-age to weight-at-age) in yield-per recruit and other related models in fishery management (Briones *et al*., 2004; Lagler, 1970).

Rieker (1978) observed that information on length-weight relationship (LWR is essential for proper assessment and management of fisheries and enables the estimation of biomass of commercial fisheries. Anene (2005) stated that length-weight relationship is an important factor in biological study of fishes and their stock assessments, adding that the LWR is particularly important in parameterizing yield equations of stock size which is helpful in estimating the weight of a fish of a

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given length. LWR can be used in studies of gonad development, rate of feeding, metamorphosis, maturity and the condition of the fish (Olurin and Aderigbe, 2006). Wreca (1994) added that length-weight relationships are very useful in fisheries research as they are useful in regional comparisons of life histories of certain fish species and in population dynamics (Nyaku *et al.*, 2008). Weatherly and Gill (1987) stated that length-weight relationships of fishes are important in fishery biology because they allow the estimation of average weight of the fish of a given length group by establishing amathematical relation between the two as affirmed by Briones *et al.*(2004) as well as for assessing the relative well - being of fish populations.

Briones *et al.*,(2004) further stressed that LWR can also be used as a character for the differentiation of taxonomic units which change with developmental event in life such as metamorphosis, growth and the onset of maturity. It is also used in setting yield equations for estimating the number of fish landed and comparing the population in space and time (Bara *et al.*, 2007). The empirical relationship between the length and weight of the fish thus enhances the knowledge of the natural history of species whose studies are scanty. Length-weight relationship (Resign, 1999) has important applications in fish stock assessment, among which include the estimation of the standing stock biomass and calculating condition indices.

This study therefore aimed at studying the length-weight relationship (LWR) and condition factor of three species of fish, namely (*Hemichromis fasciatus*), Tilapia zilli and *Oreochromis niloticus*) from two aquatic ecosystems in Imo state, Nigeria. These species are of commercial importance and contribute to economic well being of commercial fishermen. Information emanating from the study will contribute to a better understanding of the biology of this inland species of economic importance in Imo State and generate data that could be applied to the assessment and management of the fish stocks.

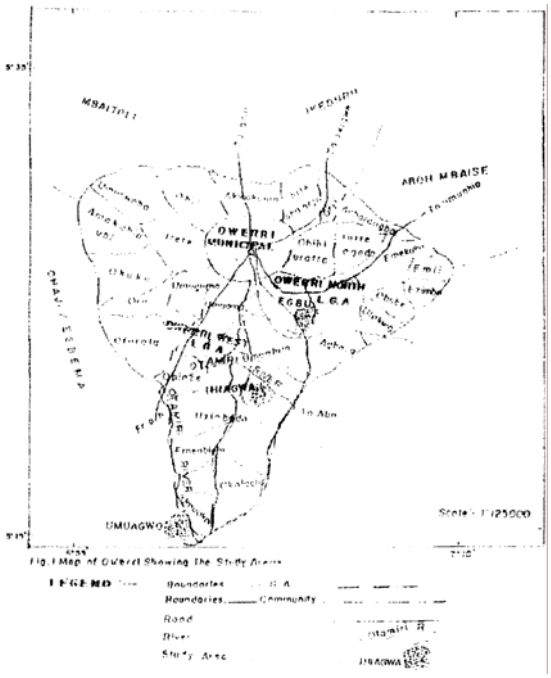
MATERIALS AND METHODS

Study area description

Fish specimens for the study were collected from two different aquatic ecosystems namely, fish ponds representing lentic environment and a river as lot of aquatic ecosystem.

The fish ponds were (1) Site and services fish farm at Area M, World Bank Owerri and (2) He- lives fish farm enterprise, Road 24 Federal Housing Estate, New Owerri, Imo State, Nigeria. The name of the river is Otamiri River. Samples were collected from three designated stations on Otamiri River as follows station A: Egbu: station B lhiagwa and station C: Umuagwo, Imo State, Nigeria.

Owerri, the study area (figure 1) lies within latitudes 6° 37" and 7° 05" North of equator and longitude 5°10' and 5° 20 East of Greenwich. It lies within the rain forest region of West Africa with an annual rainfall of 1, 500 — 2200mm, mean temperature of 28°C and relative humidity of 75% to 90%. The climate of the region is distinguished into two distinct seasons. The raining season which lasts from March to October and the dry season which is experienced between November to March.



Map of Imo State showing Otamiri River and the sampling stations.

Sampling Station	*T.Zilli*	*H.fasciatus*	*O.niloticus*	Biweekly
A	5	5	5	15
Rivers B	5	5	5	15 **45**
C	5	5	5	15
Pond	5	5	5	15 **15**
Total	**20**	**20**	**20**	**60**

Sampling design, data collection and identification

Sampling for length-weight relationship of the Cichlid fishes of Otamiri River was basedon standard methods described by Pauly (1983). Three sampling stations were designated along the river banks based on fishing sites as follows station A (Egbu), station B (lhiagwa) and station C (Umuagwo), Imo State, Nigeria. Each of the stations was sampled every forth night for Cichlid fishes for three months (May-July 2013). Specimens were purchased from fishermen at the landing sites from the stations. In order to effectively sample all the size groups of the endemic species of the Cichlid fishes, purchased specimen were augmented by hired fishermen that employed less selective gear. 360 specimens of different size groups of each fishes were sampled for evaluation, made up of 270 from the river and 90 from ponds. The layout of the design is shown in table 1.

Fish specimens purchased or landed from each station was immediately and carefully transported to the laboratory in iced boxes to avoid damage to the appendages. Thespecimens were then sorted into three size groups (fingerlings, juveniles and adult fish) and identified using a combination of keys by (Ahmed, 1997; Delgado and Mekenna, 1997;Fafioye and Oluaje 2005). Wet weight of the samples were taken and recorded in grams to the nearest 0.1gram using the 0haus tripled beam balance. The standard and total lengths were also measured

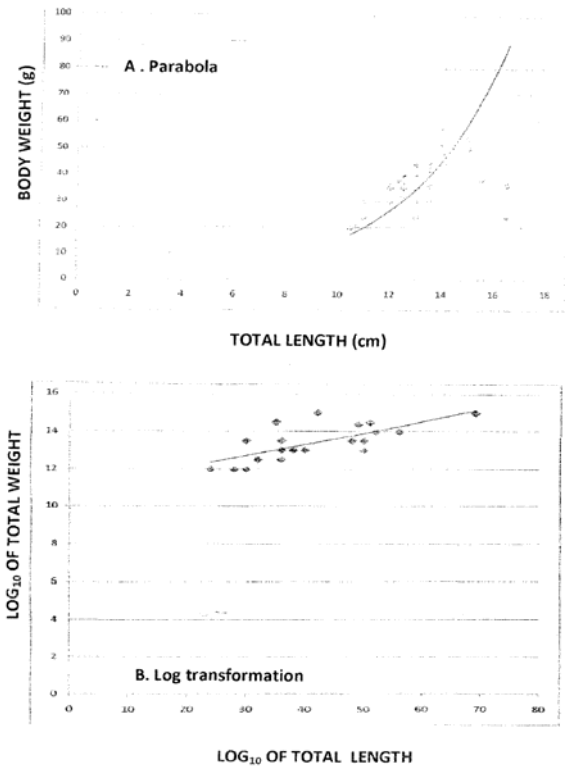


Fig. 1: Length – weight relationship of T.zilli from the pond (captive environment) in Imo State

and recorded in centimeters to nearest 0.1cm with graduated metric rule.

RESULTS

Parabolic length - weigth relationship

The length-weight relationship of Tilapia zilli from pond was $W = 0.030L^{2.75}$, while that of river (wild) was $w = 0.015L^{2.250}$. For *Hemichromis fasciatus* from the pond, $W\ 0.050L^{2.45}$, and $W = 0.045L^{2.85}$ for *Hemichromis fasciatus* from the river. *Oreochromis niloticus* was $W = 0.075L^{3.020}$ for pond and $W = 0.045L^{3.00}$ for river.

Log-log transformed length-weight relationship

The Log_{10}weight and Log_{10} length relationship of *Tilapia zilli* from the pond (captive environment) was $Log_{10}W = 2.640 + Log_{10}L\ 1.490$ while that of *Tilapiazilli* from the river (wild environment) was $Log_{10}W = 2.350 + Log_{10}L - 1.305$. For *Hemichromisfasciatus* from the pond, the relationship was $Log_{10}W = 2670 + Log_{10}L\text{-}1.560$ and $Log_{10}W = 2.850 + Log_{10}L - 1.540$ for wild fish. In the case of *Oreochromis niloticus* from the pond $Log_{10}W = 2.450 + Log_{10}L\text{-}1.156$ and $Log_{10}3.00 + Log_{10}L - 1.780$ for river fish.

Pond fishes

For fishes from the pond, b for *T. zilli* was 2.750, *H. fasciatus* (2.450), and *C. niloticus* (3.020). Whereas *O. niloticus* exhibited isometric growth rate (3.020), *T. zilli* and *O. fasciatus* exhibited allometric growth pattern. The growth pattern was also true for species caught from the river, with 'b' as follows: *T. zilli* (2.350), *H. fasciatus* (2.850) and *O. niloticus* (3.00).

The results of correlation coefficient (r) showed that in all the pond fish, length were positively but insignificantly correlated with weight (*T. zilli*, r = 0.20; *H. fasciatus*, r = 0.28) except *O. niloticus* in which length and weight were positively and highly significantly correlated (r = 1.00).

River fishes

For fishes from the river, the growth followed the same pattern as in those from the pond. For *T. zilli*, b = 2.350, *H. fasciatus* (2.850) and *O. niloticus* (3.00). Whereas *T. zilli* and *H. fasciatus* exhibited allometric growth rate, *O. niloticus* exhibited isometric growth pattern (b = 3.00)

However, the lengths of fishes from the river were more positively and significantly correlated. For *T. zilli* (r = 1.00), *O. niloticus* (1 .00). *H. fasciatus* (r = 0.40 was however, positively but insignificantly correlated.

DISCUSSION

Length-weight relationship

The length-weight relationship computed in this study for *T. zilli* from the pond ($W\ 0.030L^{2.75}$) did not differ from that of the river ($W\ 0.015L^{2.250}$) as both of them showed allometric growth rate. This is also true of the *H. fasciatus*, of $W\ 0.50L^{2.45}$ (in the pond) and $W = 0.045L^{2.85}$ (in the river).In both aquatic environments, *O. niloticus* exhibited isometric growth pattern ($W = 0.075L^{3.20}$) in the pond, and ($W = 0.045L^{3.00}$) in the river. This is in agreement with Olurin and Aderigbe, (2006).

For fishes sampled from the pond (captivity), condition factor k for *T. zilli* was 1.150, *H. fasciatus* (1.06) and *O. niloticus* (1.50). For river fish (wild environment), (condition factor k for *T. zilli* was 1.20, *H . fasciatus* (1.40) and *O. niloticus* (1.48).

The pattern of fish growth and the degree of correlation between length and weight

The pattern of growth, determined from the values of the regression coefficient (b) of the length and weight

Table 2: Log-Log transformation of length-weight relationship of three Cichlid fishes from two aquatic environments in Imo State

1. Pond

Species	Log_{10}length-Log_{10} weight relationship	b	a	r
T.zilli	$Log_{10}W = 2.640 + Log_{10}L\text{-}1.490$	2.640	-1.490	0.20
H.fasciatus	$Log_{10}W = 2.670 + Log_{10}L\text{-}1.560$	2.65	-1.560	0.28
O.niloticus	$Log_{10}W = 2.450 + Log_{10}L\text{-}1.156$	2.450	-1.150	1.00

2. River

Species	Log_{10}length-Log_{10} weight relationship	b	a	r
T.zilli	$Log_{10}W = 2.350 + Log_{10}L\text{-}1.305$	2.350	-1.305	1.00
H.fasciatus	$Log_{10}W = 2.850 + Log_{10}L\text{-}1.540$	2.85	-1.540	0.40
O.niloticus	$Log_{10}W = 3.00 + Log_{10}L\text{-}1.780$	3.00	-1.780	1.00

measurements of the species shows that the growth pattern of the respective fishes were the same in both the pond and the river systems. Whereas T exhibited isometric growth in both environments (b = 2.750 and 2.350 respectively), other species exhibited allometric growth in both environments. This observation is in agreement with the findings of Bagenal, 1978.

Conclusion

From the study, it is evident that habitat differences have no influence on length weight relationship of Cichlid fishes. The study has also confirmed that while *Oreochromis niloticus* exhibited isometric growth, other Cichlids studied all had positive allometric growth.

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