Morphometrics of Selected Fish Species from Tagwai Lake, Minna, Niger State, Nigeria

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Paper Information	A B S T R A C T
	This study was carried out to elucidate the morphometrics of three fish species namely, Tilapia galilaea, Tilapia aurea and Auchenoglanis occidentalis from Tagwai Lake, Minna, using standard procedures. A Total of 360 specimens of the fishes were analyzed. The results indicated the following ranges for parameters investigated: Body Girth (BG) (3.78±0.76 to 5.48±0.84cm), and Total Gut weight (TGW) (2.10±0.84 to 3.12±1.73g); values that did not vary significantly (P>0.05) among the fish species. On the other hand, standard length (SL) (range = 10 .94±1.34 to 20.46±2. 98cm), Gut Length (GL) (range = 25.92± 6.67 to 139.77±30.56cm) and Total Body Weight (TBW) (range = 49 .99±18.34 to 175.31± 66.96) varied significantly (P<0.05). Cross correlation amongst certain morphometric variables, i.e., Standard Length and Total Body Weight, Body Girth and Total Body weight, Total Gut Weight and Standard Length were strong (r≥0.7), while Standard Length and Gut Content Weight, Gut Length and Standard Length, Gut Content Weight and Standard Length were weakly correlated (r<0.7). This findings no doubt support close evolutionary ties among the species, and should provide baseline information for sustainable exploitation of the fish species.

Key words: *Auchenoglanis occidentalis, Standard Length, Body Girth, Tilapia galilaea, Tilapia aurea*

Introduction

From time immemorial, fishes have been of great economic importance to man, with communities in the coastal as well as inland areas depending greatly on fishery for their incomes and source of animal protein (Espinosa–Lemus et al., 2009). To meet these needs, man had always depended on fishery from the wild. Initially, supply of fishery products from the wild was able to satisfy human needs, but with the recent explosion in human populations, environmental degradation, and habitat destruction, the production of fishery resources from the wild have diminished greatly, with tremendous negative impacts on human needs (Ajah et al., 2006). This development expectedly led to wild fishery, and ultimately the domestication of certain fish species for intensive cultivation in captivity. Unfortunately, the few fish species successfully domesticated have not been able to meet the increasing human demand for fishery resources. Thus, there is an urgent need for the domestication and intensive culturing of more fish species. Interestingly, the success of expanded aquaculture must be predicted on a sound knowledge of the biology, ecology, and habitats of targeted fish species.

Understanding the morphometrics of these fish species will enhance the development of cost effective aquaculture protocols, thus increase in productivity. To this end, not much work has been done on the morphometrics of these fish species. Also, comparative study of the morphometrics of these three

fish species can provide relevant information for polyculture of the three fish species, thereby, promoting cost-effectiveness.. The study, therefore, aimed at elucidating the morphometrics of Tilapia galileae; Tilapia aurea and Auchenoglanis occidentalis from Tagwai Lake, Minna, Niger state.

Materials And Methods
Description of Study Area
The study was carried out in Minna, the capital of Niger state, North Central Nigeria. Minna is located within longitude $6^0 33^'E$ and latitude 9^0 $37^'N$, covering a land area of 88km, with an estimated human population of 1.2 million. The area has a tropical climate with mean annual temperature, relative humidity and rainfall of 30.20^0C, 61.00% and 1334.00mm, respectively. The climate presents two distinct seasons, a rainy season (May to October) and a dry season (November to April). The vegetation in the area is typically grass-dominated with scattered tree species. Tagwai lake is about 10 km away from Minna town. The lake is about 25m deep, 1.8 km wide and has a capacity for storing 28.3 million cubic meters of water.

Specimen Collection and Species Identification
Specimen collection was performed weekly by purchasing representative samples of the three selected fish species from local fishermen. These were transported to the laboratory for further processing. The three fish species were identified using standard keys (Reed el al., 1967; Olaosebikan, 2004).

Morphometric Analyses
Standard length was determined, using a meter rule, by measuring the length from tip of the mouth to beginning of the tail fin. The Total Body weight (TBW) and Total Gut Weight (TGW) were determined using electronic scale. The Body Girth (BG), which is the diameter of the specimen at the broadest region, was determined using a ruler, by placing the ruler on the dorsal fin and extending it to the ventral side.

Data Analysis
Data collected were processed as mean±SD and subjected to standard statistical analysis, using the Chi-square test. All statistical tests were carried out at P = 0.05 level of significance.

Results
Table 1 shows the distribution of morphometric variables among the selected fish species from Tagwai lake. While some variables namely, Body Girth (BG), Total Gut Weight (TGW) did not vary significantly (P>0.05) among the species, others such as standard length, varied significantly (P<0.05). Generally, SL ranged from 10.94±1.34cm, in Tilapia aurea to 20.46±2.98cm in Auchenoglanis occidentalis. The same trend was recorded in the total body weight, whereby Aucheglanis occcidentalis was significantly heavier (175.3±66.96g) than the other two species, with Tilapia aurea having a mean TBW of 49.99±18.344g.

However, the trend was reversed in gut length, whereby Tilapia galileae had the longest gut length (mean= 139.77±30.56cm), Unlike in the previous two morphometric variables, Auchenoglanis occidentalis and Tilapia aurea had the smallest Gut height (25.92 ± 6.67cm).
Although BG and TGW were not significantly different amongst the species, Tilapia galileae had the highest value of BG and TGW (5.48±0.84cm and 3.12±1.73g, respectively).
The results for test of cross-correlation among morphormetric variables for the different species are highlighted in Tables 2, 3 and 4. Generally, all such correlations were positive for the three species, but while some variables were strongly correlated, others were weakly so. For Tilapia galileae, SL was

significantly correlated (r≥0.7) with all other morphometric variables. With the exception of the correlation between TBW and BG, all other morphometric cross correlations for Tilapia galileae were insignificant (r<0.70) (Table 2). Significant correlations among morphormetric variables were restricted to those between SL and TBW, BG and TGW; in addition to those between TBW and BG, while all other correlations were significant (Table 3). The distribution of cross correlations among morphormetric variables in Auchenoglanis occidentalis is more or less similar to those of Tilapia aurea. However, the correlation between SL and TGW was weak, while those between TBW and GCW as well as TGW and GCW were significant (Table 4).

Table 1. Morphometric characterization of selected fish species from Tagwai Lake, Minna, Nigeria

SPECIES	SL(cm)	TBW(g)	BG(cm)	TGW(g)	SCW(g)	GL(cm)
Tilapia aurea	$10.94\pm1.34^{a*}$	49.99 ± 18.34^{a}	4.10 ± 0.57^{a}	3.11 ± 1.96^{a}	0.77 ± 0.93^{a}	87.61 ± 21.41^{b}
Tilapia galileae	13.14 ± 1.79^{a}	101.83 ± 35.70^{b}	5.48 ± 0.84^{a}	3.12 ± 1.73^{a}	0.47 ± 0.32^{a}	139.77 ± 30.56^{c}
Auchenoglanis occidentalis	20.46 ± 2.98^{b}	175.31 ± 66.96^{c}	3.78 ± 0.76^{a}	2.10 ± 0.84^{a}	1.02 ± 0.51^{a}	25.92 ± 6.67^{a}

SL = Standard Length; TBW = Total Body Weight; BG = Body Girth; TGW = Total Gut Weight; SCW = Stomach Content Weight; GL = Gut Length
*Values followed by same superscript alphabets in a column are not significantly different at P = 0.05 level of significance

Table2. Cross-correlation among morphometric features in Tilapia galileae population from Tagwai Lake, Minna

Morphometric Attributes		SL(cm)	TBW(g)	BG(cm)	TGW(g)	SCW(g)	GL(cm)
SL		1.0000					
TBW		0.9429*	1.0000				
	BG	0.9434*	0.8000*	1.0000			
TGW		0.9398*	0.3561	0.3957	1.0000		
GCW		0.9392*	0.3246	0.3644	0.4770	1.0000	
GL		0.8287*	0.3031	0.3926	0.4610	0.1764	1.0000

*Significant correlations.

SL = Standard Length; TBW = Total Body Weight; BG = Body Girth; TGW = Total Gut Weight; SCW = Stomach Content Weight; GL = Gut Length

Table 3. Cross Correlation among morphometric features in Tilapia aurea population from Tagwai Lake, Minna, Nigeria

Morphometric Attributes		SL(cm)	TBW(g)	BG(cm)	TGW(g)	SCW(g)	GL(cm)
SL		1.0000					
TBW		0.7587*	1.0000				
	BG	0.7621*	0.7809*	1.0000			
TGW		0.7520*	0.7992	0.5477	1.0000		
GCW		0.2201*	0.3386	0.2033	0.4678	1.0000	
GL		0.3404*	0.3529	0.3884	0.4519	0.1702	1.0000

*Significant correlations.

SL = Standard Length; TBW = Total Body Weight; BG = Body Girth; TGW = Total Gut Weight; SCW = Stomach Content Weight; GL = Gut Length

Table4. Cross Correlation among morphometric features in Auchenoglanis occidentalis population from Tagwai Lake, Minna, Nigeria

Morphometric Attributes		SL(cm)	TBW(g)	BG(cm)	TGW(g)	SCW(g)	GL(cm)
SL		1.0000					
TBW		0.9433*	1.0000				
	BG	0.8523*	0.8544*	1.0000			
TGW		0.2816*	0.6769	0.2909	1.0000		
GCW		0.2205*	0.6095	0.2719	0.6933	1.0000	
GL		0.3150*	0.3848	0.2010	0.5513	0.3182	1.0000

*Significant correlations.

SL = Standard Length; TBW = Total Body Weight; BG = Body Girth; TGW = Total Gut Weight; SCW = Stomach Content Weight; GL = Gut Length

Discussion

The results obtained in this study were quite revealing, as they helped in putting the morphometrics of the selected fish species in better perspective. While some o the findings were consistent with those obtained earlier elsewhere (Adeyemi et al., 2009), others contradicted such results (Eyo, 2003), and yet a number of the finding were quite unique. The significant variations in standard length (SL) among the three fish species may be due to genetics differences. Also, the TBW had similar pattern of distribution as SL, confirming significant difference in body mass hence profitability, if and when these species are domesticated. The significant variation among members of the three species in morphological variables has some ecological implications and suggests similar breeding and behavioral ecology in the species. For example, significant variation in SL and TBW may indicate all-year- round breeding activities as an explanation for having extremely diverse sizes and perhaps age group ranges in population of the specimen. This observation suggests that the species may not be cannibalistic or piscivorous, as both the bigger and much smaller individuals co-existed.

The results of this study also indicate positive correlations among morphometric variables investigated, most of which were significant. This finding, no doubts, supports close evolutionary ties among the species and, perhaps, suggests common biological and ecological requirements.

Conclusion

The findings of this study revealed that the morphometric features of the populations of Tilapia galileae, Tilapia aurea and Auchenoglanis occidentalis in the Tagwai Lake Minna, were similar in certain respects, but significantly different in others. These observations indicate close evolutionary relationships and differential responses to environmental conditions, respectively.

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